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DOES PATCH DENSITY OF *GNAPHALIUM ROBUSTUM* PHIL. INFLUENCE HERBIVORY BY *HELICOVERPA ZEA* (BODDIE) LARVAE?[1]

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ABSTRACT

The consumption of inflorescences of *Gnaphalium robustum* Phil. (Asteraceae) by larvae of *Helicoverpa zea* (Boddie) (Lepidoptera: Noctuidae) was studied as a function of patch density. Plants in low density patches had a greater number of branches than in high density patches (3.82 ± 0.83, 1.90 ± 0.15, mean ± SE, respectively, $P < 0.001$). Low density patches had a greater number of larvae per plant than high density patches (4.18 ± 1.14, 1.32 ± 0.20, mean ± SE, respectively, $P < 0.001$). The number of branches per plant was positively correlated with the number of larvae per plant (Spearman rank order correlation, R = 0.37, $P < 0.001$). The results suggest that the distribution of larvae between patches may be explained by the edge effect.
Key words: *Gnaphalium robustum*, herbivory, *Helicoverpa zea*.

RESUMEN

El consumo de inflorescencias de *Gnaphalium robustum* Phil. (Asteraceae) por larvas de *Helicoverpa zea* (Boddie) (Lepidoptera: Noctuidae) fue estudiado como función de la densidad de parche. Plantas en parches de baja densidad tuvieron un mayor número de ramas que aquellas en parches de alta densidad (3.82 ± 0.83, 1.90 ± 0.15, promedio ± EE, respectivamente, $P< 0.001$). Los parches de baja densidad tuvieron un mayor número de larvas por planta que aquellos de alta densidad (4.18 ± 1.14, 1.32 ± 0.20, promedio ± EE, respectivamente, $P < 0.001$). El número de ramas por planta correlacionó positivamente con el número de larvas por planta (correlación de Spearman, R = 0.37, $P < 0.001$). Los resultados sugieren que la distribución de larvas entre los parches es consistente con el efecto de borde.
Palabras claves: *Gnaphalium robustum*, herbivory, *Helicoverpa zea*.

INTRODUCTION

Plants and insects are united by intricate relationships (Crawley, 1997; Jones, 1992; Karban *et al*., 1989; Price, 1997); in fact, insects with their overwhelming variation in form and life history may have been one of the forces in shaping the plant world - the primary source of energy-rich compounds (Schoonhoven *et al.*, 1998; Rosenthal & Welter, 1995). Two main strategies that explicitly include spatial arrangement of patches have been proposed to explain the behavior an insect may follow in search for food or for an oviposition site (Folgarait *et al*., 1995). The resource concentration hypothesis, proposed by Root (1973), states that herbivores are most likely to find and remain on hosts that are growing in dense of nearly pure stands. The "edge effect" (see Jones, 1992) explains the cases where isolated plants receive more eggs per plant than plants in groups, and plants in sparse patches receive more eggs per plant than plants in

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dense groups. Thus, the density of host-plant patches may affect the distribution of herbivorous insects (Folgarait *et al.*, 1995; Jones, 1992; Kareiva, 1982; Rosenthal & Welter, 1995).

The annual species, *Gnaphalium robustum* Phil. (Asteraceae) present at Río Clarillo National Reserve (Hoffmann, 1998), suffers herbivory at its inflorescence by larvae of *Helicoverpa zea* (Boddie) (Lepidoptera: Noctuidae) (Artigas, 1994). In this study, we address the effect of patch density and architecture (number of branches) of *G. robustum* on abundance of *H. zea* larvae. We hypothesize that decreased patch density increases branching in *G. robustum* plants and herbivory by *H. zea* larvae.

MATERIAL AND METHODS

Gnaphalium robustum was found to grow in degraded sun-exposed terrains of the Río Clarillo Natural Reserve (33°51'S, 70°29'W, 45 km southeast of Santiago, Chile) in patches of different sizes (Hoffmann, 1998). Ten patches of low plant density ($\leq$ 5 plants per 3m x 3m quadrant) and eleven at high plant density ($\geq$ 24 plants per 3m x 3m quadrant) were selected.

The inflorescences in each patch were thoroughly examined for the presence of the larvae. All plants in the low density patches were sampled, while only 20% of the plants were inspected in the high-density patches. A total of 428 plants were sampled. The parameters recorded were: number of larvae per branch, number of branches per plant, and plant height.

The data did not meet the assumptions of a parametric distribution, hence a Kruskal – Wallis ANOVA was employed.

RESULTS

Plants in low density patches had a greater number of branches than in high density patches (3.82 ± 0.83, 1.90 ± 0.15, mean ± SE, respectively, $P < 0.001$). Plant height in low density patches did not differ significantly from high density patches (67.73 ± 3.50, 66.29 ± 0.96, mean ± SE, respectively, $P > 0{,}05$). Low density patches had a greater number of larvae per plant than high density patches (4.18 ± 1.14, 1.32 ± 0.20, mean ± SE, respectively, $P < 0.001$). Likewise, low density patches had a greater number of larvae per branch per plant than high density patches (1.44 ± 0.29, 0.73 ± 0.07, mean ± SE, respectively, $P < 0.001$). The number of branches per plant was positively correlated with the number of larvae per plant (Spearman rank order correlation, $R = 0.3716$, $P < 0.001$), but not with the number of larvae per branch per plant ($R = 0.056$, $P = 0.226$).

DISCUSSION

The evaluation of the structure of the plant suggests that plants on high density patches were under a competition for light, and also soil resources, hence tended to keep apical dominance, while plants found in places with low density may have experienced less competition and showed an increased number of branches (biomass).

The number of larvae per branch was independent of patch density, suggesting that larvae will not overload each branch, which could be an strategy to avoid competition, aggression, or depletion of the resource.

Each plant contained fewer larvae in the high density patches, a result that held after correction for branches per plant was introduced. In fact, a positive and significant correlation was found between the number of branches per plant (biomass) and the number of larvae per plant. Hence, the results suggest that the presence of *H. zea* larvae in *G. robustum* is better explained by the "edge effect".

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